

# A CMM ROAD MAP FOR DOE-EM

The U.S. Department of Energy Office of Environmental Management (DOE-EM) embarked on environmental management technology development in 1989 with the formation of the Office of Technology Development, later known as the Office of Science and Technology (OST), and began aggressively supporting characterization, monitoring, and sensor technology development for environmental management and cleanup. Numerous EM challenges have been addressed by OST. Many successful technologies have been created and deployed at DOE sites and have become commercial successes as a result of OST investments over the years.

Nonetheless, challenges remain which need to be solved to support the DOE environmental mission. This **CHARACTERIZATION, MONITORING, AND MODELING SCIENCE AND TECHNOLOGY DEVELOPMENT ROAD MAP** enumerates these needs and the impact which their solutions can have, describes proven solution paths and their application to several of the challenges currently visible within DOE-EM, and outlines tested programmatic strategies that can be used in bringing about solutions to these problems. The **Visions for 2012** foresee a potential for even greater advances in characterization and monitoring practice during the next decade than have been achieved already. DOE-EM can help to realize these visions by building on its past accomplishments and broad expertise and resources in characterization, monitoring, and modeling (CMM) science and technology development.

The purpose of this **ROAD MAP** is to assemble information on the current state of DOE-EM CMM development and to identify directions toward which further development is needed. No distinction is made in this document between research and development (R&D) areas traditionally identified with OST Characterization, Monitoring, and Sensor Technology Crosscutting Program (CMST-CP) and areas identified with other DOE-EM programs.

There are five major parts:

- ! **INTRODUCTION** provides a concise overview of the document, focusing on the process used to identify the site environmental management and cleanup needs that generate the science and technology development challenges it presents. The challenges fall into two major categories: **Waste, Source, and Nuclear Materials Characterization** and **Process and Product Monitoring**. In addition, three areas are identified for special emphasis: **Long-Term Monitoring; Nondestructive Methods**; and **Improved Scientific Understandings**. The general nature of the challenges faced in each area is discussed; broadly stated targets for DOE are suggested (see the boxes on pages 4-8); and a number of currently **Visible and Important Problems (VIPs)** are recognized. Selected **VIPs**, with solution paths, are highlighted in sections beginning on page 12 and again on page 34; more detailed discussion is reserved for **APPENDIX B**. Finally, the **INTRODUCTION** closes with a brief discussion of programmatic strategies DOE-EM has used successfully in addressing these and similar science and technology development challenges.

- ! **PROBLEM AND OPPORTUNITY AREA HIGHLIGHTS** provides a more detailed breakdown of the two major categories and three special emphasis areas. A general description of baseline technologies and their deficiencies with respect to meeting DOE-EM needs is given, along with an enumeration of the objectives which further science and technology development could accomplish. Sub-areas (groups of similar technology development needs) are identified and described in greater technical detail. Finally, for each area a **Vision for 2012** describes an attractive future state of affairs that can be attained through following the recommendations in this **ROAD MAP**.
- ! **SOLUTION PATHS** describes proven ways that DOE-EM can use to identify R&D providers, convey funding to them, monitor their progress, and test and demonstrate their projects. Brief examples are based on two **VIPs**; more detail is provided in **APPENDIX B**.
- ! **APPENDIX A: PROBLEM AND OPPORTUNITY AREAS** returns to the major categories and special emphasis areas. Needed technology development is described in detail within larger, crosscutting groups of needs. DOE-EM **Critical Application Areas (CAAs)** related to each challenge are identified. Few of these challenges are identified by specific site, as nearly all are common to at least a few sites. **Near-Term Goals** and **Far-Term Goals** are suggested in each section. These are listed at the close of this summary, beginning on page ix. Also included in **APPENDIX A** are listings of **OST CMM R&D Successes** and **Recent R&D Projects**. Although one cannot foresee all needs that might arise while environmental management and cleanup activities are proceeding, **APPENDIX A** provides a comprehensive vision of goals that DOE-EM should consider pursuing during the coming decade.
- ! **APPENDIX B: SELECTED VISIBLE AND IMPORTANT PROBLEMS** describes several **VIPs** in substantial detail, including both technical aspects of each challenge and proposed response strategy and a programmatic approach for solving the problem. The purposes of **APPENDIX B** are to provide greater detail about the **VIPs** and to illustrate successful strategies which have been employed by DOE-EM, utilizing the resources of the CMST-CP in many cases. It would be beyond the scope of any single document of manageable size to provide individual solution strategies for each of the many CMM R&D challenges presented by DOE-EM's environmental management and cleanup mandate.

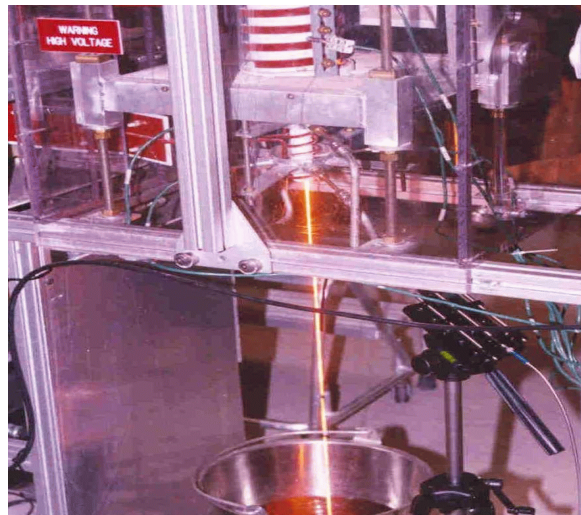
Each **APPENDIX** has its own Table of Contents. Readers desiring a very concise enumeration of the many CMM science and technology development challenges facing DOE-EM may wish to begin by scanning the **APPENDIX A** Table of Contents (pages A.i - A.iii) before turning to the **INTRODUCTION**.

A few elements typically found in Technology Development Road Maps and Programmatic Road Maps are not included in this document. In particular, the variety of specific goals is quite broad, and there is little or no programmatic or technical dependence among goals in most cases, so it makes little sense to develop critical path displays for the document as a whole. Moreover, details about what technology is needed when and by whom involve prioritizations and funding decisions not in the purview of CMST-CP and therefore beyond the scope of this document. Hence specific timetables are not provided, beyond those implied by the terms "Near-Term Goals" and "Far-Term Goals". Similarly, each "Vision for 2012" is not so much a statement about actions required by a specific future date as about a new way of approaching characterization and monitoring which will be feasible once a certain amount of development work has been accomplished. It is viewed that the R&D needed to bring about these advances is an ambitious but achievable ten-year goal.

Hence, this **ROAD MAP** serves not so much as a trip map to a specific goal, as would be expected of a technology development or program road map, but rather as a traveller's guidebook identifying and describing numerous highly desirable goals, many of which are potentially quite important for DOE-EM success, along with paths to take and strategies to employ in addressing and attaining those goals.

In summary, this **CHARACTERIZATION, MONITORING, AND MODELING ROAD MAP FOR DOE-EM** provides

- ! broad **Visions** for DOE-EM to strive toward during the next decade, outlined in boxes on pages 4-8 with more detailed discussions in **PROBLEM AND OPPORTUNITY AREA HIGHLIGHTS**;
- ! selected **Visible and Important Problems (VIPs)** of current interest, highlighted on pages 12-19 and 34-41 with in-depth discussions in **APPENDIX B**;
- ! identification of broad, cross-cutting **Problem and Opportunity Areas** that emphasize the commonality of challenges in the various critical application areas that DOE-EM should consider addressing, described in highlight form in pages 21-33 and in greater detail in **APPENDIX A**;
- ! delineation of **Near-Term Goals** and **Far-Term Goals** for DOE-EM Science and Technology Development, discussed in **APPENDIX A** with a summary listing following immediately on pages ix-xiii;
- ! discussions of tested **Strategies** to identify projects to be undertaken (pages 9-11) and proven **Solution Paths** for those projects (pages 43-44 and **APPENDIX B**); and
- ! listings of **OST CMM R&D Successes** and **Recent R&D Projects** for each of the Problem and Opportunity Areas.



TechID 2004: Monitor for TRU in Molten Glass